

IN THE SPECIFICATION

Please insert before the first line the following paragraph:

-- This application is a divisional of copending U.S. patent application number 09/790,865, filed February 23, 2001. --

Please substitute the paragraph beginning at page 1, line 16, and ending on page 2, line 4, with the following.

-- Generally, projection optical systems in projection exposure apparatuses use a dioptric optical system or a catadioptric optical system. However, with light ~~or~~ having a short wavelength, usable glass materials are limited and, for this reason, correction of chromatic aberration becomes difficult. On the other hand, a catadioptric type optical system has a large advantage because it is effective ~~in~~ with respect to removal of chromatic aberration. There are a few types using a catadioptric optical system. For example, Japanese Laid-Open Patent Application, Laid-Open No. 300973/1994 shows one using a cube type beam splitter. Further, Japanese Laid-Open Patent Application, Laid-Open No. 10431/1998 and corresponding U.S. Patent No. 5,537,260 show which forms an intermediate image. --

Please substitute the paragraph beginning at page 2, line 20, and ending on page 3, line 21, with the following.

-- Figure 7 shows a catadioptric optical system such as disclosed in Japanese Laid-Open Patent Application, Laid-Open No. 10431/1998, which is a small-size catadioptric system having a sufficiently large numerical aperture in the image side and work distance, and having a

resolution of a quarter-micron unit in the ultraviolet region. Light from an object is reflected by a concave reflection mirror CM of a first imaging optical system S1 and, thereafter, it forms an intermediate image on the light path of the first imaging optical system S1. This intermediate image is then imaged by a second imaging optical system S2 upon the wafer surface, through a first optical path changing member M1. The first imaging optical system S1 has an imaging magnification which is to be set from 0.75 to 0.95, by which the light path deflection by the first light path deflecting member M1 is enabled and, on the other hand, the image side numerical aperture NA of the optical system is made large. Further, the value of $L1/LM$ ($L1$ is the axial distance between the object plane and the intersection of the optical axes of the first imaging optical system S1 and of the second imaging optical system S2, and LM is the axial distance between the object plane and the concave mirror CM) is set to be from 0.13 to 0.35, by which the image side working distance of the optical system is assured and, additionally, ~~coma~~ coma and distortion aberration are well corrected. --

Please substitute the paragraph beginning at page 5, line 22, with the following.

-- In these aspects of the present invention, at least one of spherical aberration, astigmatism and curvature of field, produced with a heat, a pressure or an illumination condition, may be corrected. --

Please substitute the paragraph beginning at page 6, line 10, with the following.

-- ~~Comma~~ Coma aberration and distortion aberration as asymmetrical aberrations of said projection optical system may be adjusted by motion of an optical element disposed on a single way of the light path. --

Please substitute the paragraph beginning at page 11, line 27, and ending on page 12, line 6, with the following.

-- Since the lenses 3 and 3' are asymmetrical with each other with respect to the aperture stop, any asymmetrical aberrations such as ~~comma~~ coma aberration and distortion aberration to be produced by the lenses 3 and 3' have opposite signs and, thus, they can be cancelled with each other when combined. As a result, only a very small aberration remains. --

Please substitute the paragraph beginning at page 12, line 7, with the following.

-- On the other hand, regarding any symmetric aberrations such as spherical aberration, astigmatism and curvature of field, for example, those produced by the lenses 3 and 3' have the same sign and they are combined with each other. Therefore, a large aberration is produced, as compared with a case where only one lens is used (the light passes only once). When the concave mirror MR1 and the lenses 3 and 3' are placed close to each other, the amount of aberration will become about twice larger than a case where only one lens is used. --

Please substitute the paragraph beginning at page 19, line 7, with the following.

-- In this embodiment, in regard to various aberrations to be produced by a temperature change due to the exposure process or a change in pressure or in illumination condition, both of

symmetric aberration such as spherical aberration, astigmatism and curvature of field and asymmetric aberration such as ~~comma~~ coma and distortion, can be corrected. --

Please substitute the paragraph beginning at page 19, line 14, with the following.

-- ~~Where~~ When aberrations are produced for these reasons, first, the lens 9 inside the first lens group LG1 is moved in the optical axis direction, by which asymmetric aberration is corrected. --

Please substitute the paragraph beginning at page 19, line 18, with the following.

-- ~~Where~~ When the NA of the optical system is large, motion of the lens 9 causes a small change in symmetric aberration thereof. Thus, the lens 3 inside the second lens group LG2 may be moved in the optical axis direction, while also taking this aberration change into account. With this operation, the symmetric aberration can be corrected substantially without changing the asymmetric aberration. In this embodiment, through the procedure described above, both the asymmetric aberration and the symmetric aberration can be corrected. This technology can be applied to the second and third embodiments described above. --

Please substitute the paragraph beginning at page 20, line 11, with the following.

-- The present invention can be applied to a conventional projection optical system. Here, such an embodiment will be described with reference to Figure 8. Figure 8 shows a conventional catadioptric type projection optical system such as disclosed in Japanese Laid-Open Patent Application, Laid-Open No. 20195/1998, for example. A lens or lenses adjacent to a concave

mirror, in the reciprocating light path, in this optical system may be moved along the optical axis direction. The amount of changes in aberration caused by such lens ~~motion~~, motion will be described. --

Please substitute the paragraph beginning at page 20, line 22, with the following.

-- Table 1 below shows aberrations ~~in on~~ an occasion ~~where~~ when the two concave lenses (LM) in the reciprocating light path, adjacent the concave mirror MR1, are moved simultaneously along the optical axis direction (toward the concave mirror) by 1 micron. --

Please substitute the paragraph beginning at page 21, line 17, with the following.

-- In this example, since the spherical aberration changes large, the lens system LM is used for adjustment of the spherical aberration. At the same time, ~~comma~~ coma aberration (wavefront aberration asymmetric component) or imaging point positional deviation (due to a change in magnification or in distortion aberration) will change slightly.

Please substitute the paragraph beginning at page 21, line 24, and ending on page 22, line 3, with the following.

-- Thus, when the present invention is applied to this embodiment, not only may the lens system LM at the reciprocating light path shown be moved but also some lenses at the ~~singly~~ single way of light path may be moved along the optical axis direction. This enables correction of varying magnification and distortion aberrations as well as ~~comma~~ coma aberration. --

Please substitute the paragraph beginning at page 22, line 4, with the following.

-- In accordance with the embodiments of the present invention as described above, a lens which is adjacent to an aperture stop (pupil) position and disposed at a reciprocating light path so that light passes therethrough twice, is moved along the optical axis direction, thereby to correct symmetric aberrations. ~~Since, with~~ With this arrangement, the symmetric aberration changes largely as compared with a case where a lens at a ~~singly~~ single way of light path is moved. Thus, the range for correctable aberration becomes larger. Further ~~where~~ when the aberration correction of the same amount is made, it can be done with a shorter stroke and in a shorter time. --